Panel Discussion: Public Issues/Concerns Regarding Microbial Biological Control

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Microbial Biocontrol of Arthropods, Weeds, and Plant Pathogens: Risks, Benefits and Challenges, National Conservation Training Center (NCTC) Shepherdstown, WV, November 29, 2010.

Perceptions of risk with microbial biocontrol agents (whether true or false).

- Canadian survey in 1995
  - 1000 participants
  - BioControl. 2010.55: 445-454

Major findings

- 80% interested in the environment
- 55% considered themselves well versed in biocontrol
- Younger (<25) and older (>65) people were less concerned over food safety than women in general and those between 25 and 65
- Majority believed that organic farming and biological control produced safer food than that protected with synthetic insecticides

- However, 45% expressed concern over food safety when the question included the term “beneficial microbes”
- Over 80% expressed food treated with biological controls should be thus labeled

Conclusions of survey

- Public has number of misconceptions
- Need for appropriate outreach activities
  - Strengths & limitations of biological control
  - Youth should be especially targeted

My experience

- General lack of knowledge of microbial ecology even among many biologists
  - Microbes are living organisms and have very similar ecological properties and requirements as other organisms
    - Because some cause disease, all are suspect
    - Major misconception
      - Establishment of indigenous microbials in non-target populations
      - Highly unlikely!

- The first question I usually get after a talk
  - What if they mutate?
    - Perception is that a single mutation will turn the microorganism into a monster!
      - Not surprising as public reminded yearly that last year's influenza virus has now mutated and new immunization is required
      - Hollywood hasn't helped!
    - Augmentation of microorganisms in the environment will increase chances of mutations occurring???

- Pathogen establishes in non-target population and affects non-target **outside** of area of application
  - If non-targets are directly affected within area of application, the effect is no different than application of a chemical
  - Highly unlikely with indigenous organisms

Pathophobia!!

- Bacteria
- Fungi
- Protozoa
- Viruses
- Mutations

Examples of negative effects: disruption of food webs, competitive displacement, indirect effects of microbial agents

- Whenever a population is altered
  - There are consequences to the ecosystem
    - Positive or negative
    - What happens to the ecosystem when a farmer plows a field and establishes a mono-culture?
- Consequences of rapid population decline to an ecosystem are well known
  - Loss of a biological resource

Indigenous organisms

- Direct impacts to non-targets closely related to host common
  - However no evidence that the microbials become established in the non-targets
  - Direct impacts on parasitoids competing for same resource
- Indirect impacts due to host depletion
  - Host depletion desired effect

Classical control

- Although many negative examples of past introductions of vertebrates & invertebrates
  - Not aware of any negative effects of intentional introductions of microbials against insects

Predicting unintended interactions/Non-target effects in field

- Important if introducing exotics
  - Ecology best studied in the agent's native habitat
- Not very important with indigenous organisms
  - If there is a negative effect, it is short-lived
- Laboratory host range testing provides minimal useful information
- Only sure way to find out is to use them on a wide scale

Positive effects of microbial control: What's gone right? Benefits of microbial biocontrol in mitigation of ecosystem disruption, species loss, ecosystem restoration, etc

- Slower acting & seldom providing 100% control
  - Leave resources for other organisms (predators)
    - Important in IPM
- Host specificity allows integration with other biologicals
  - Excellent examples in greenhouse industry

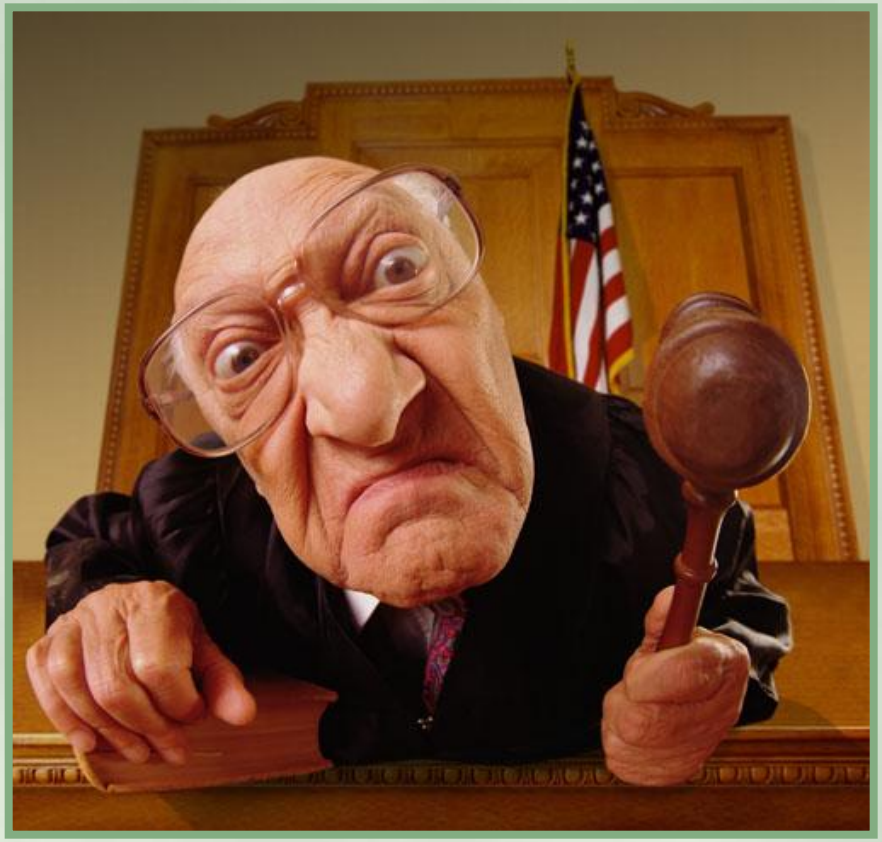
Examples

- Baculoviruses to manage codling moths in European orchards
- Bacterium *Bacillus thuringiensis* for management loopers in greenhouse pepper in Canada
  - Example of resistance when IPM not used!
- Devastation of introduced gypsy moth infestations by fungus *Entomophaga maimaiga* in the US
- Monitoring aphid populations in cotton to conserve fungal pathogen

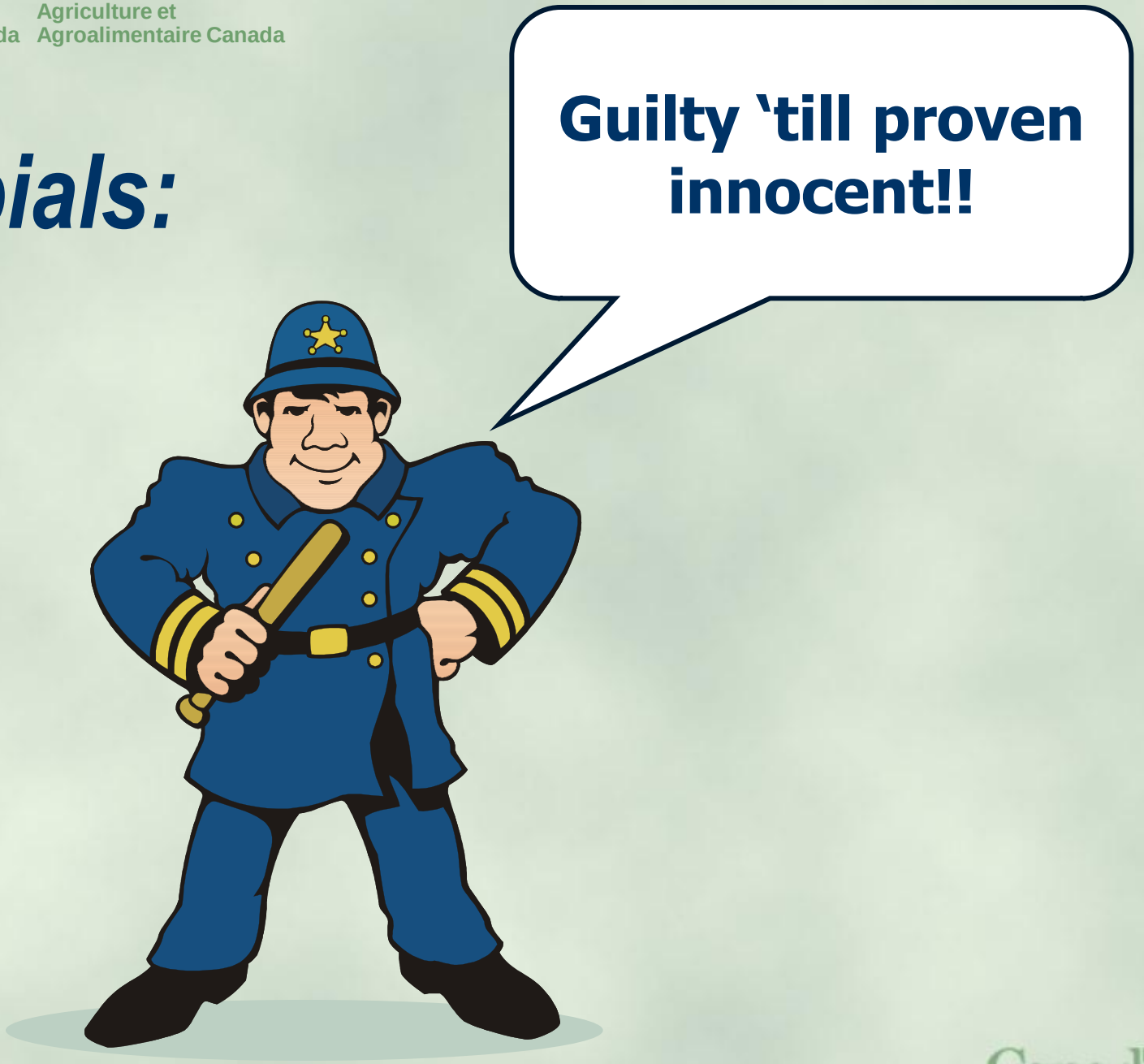
- Most examples and successes come from countries where regulatory hurdles have been minimal or non-existent
  - Allows rapid commercialization and implementation
  - Long history of beneficial use

Basic Principle

- Innocent until proven guilty!

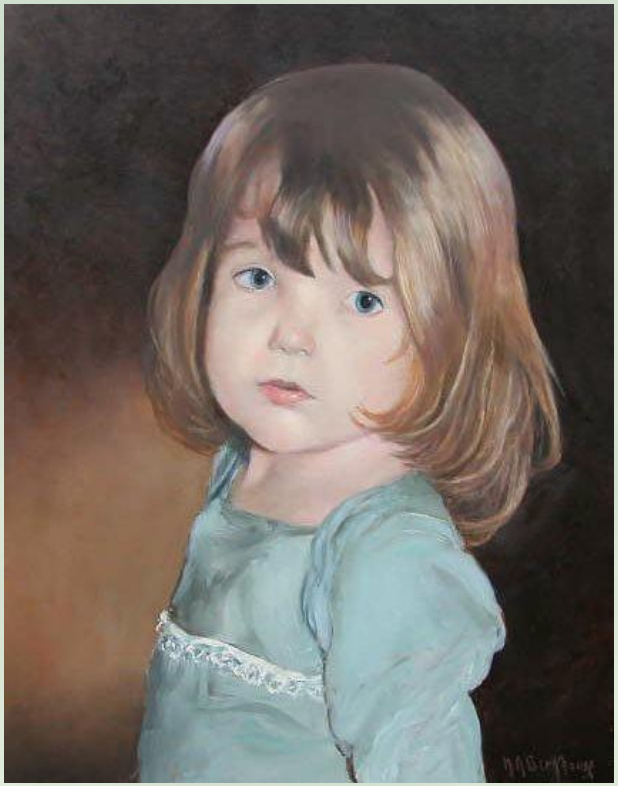


Microbials:



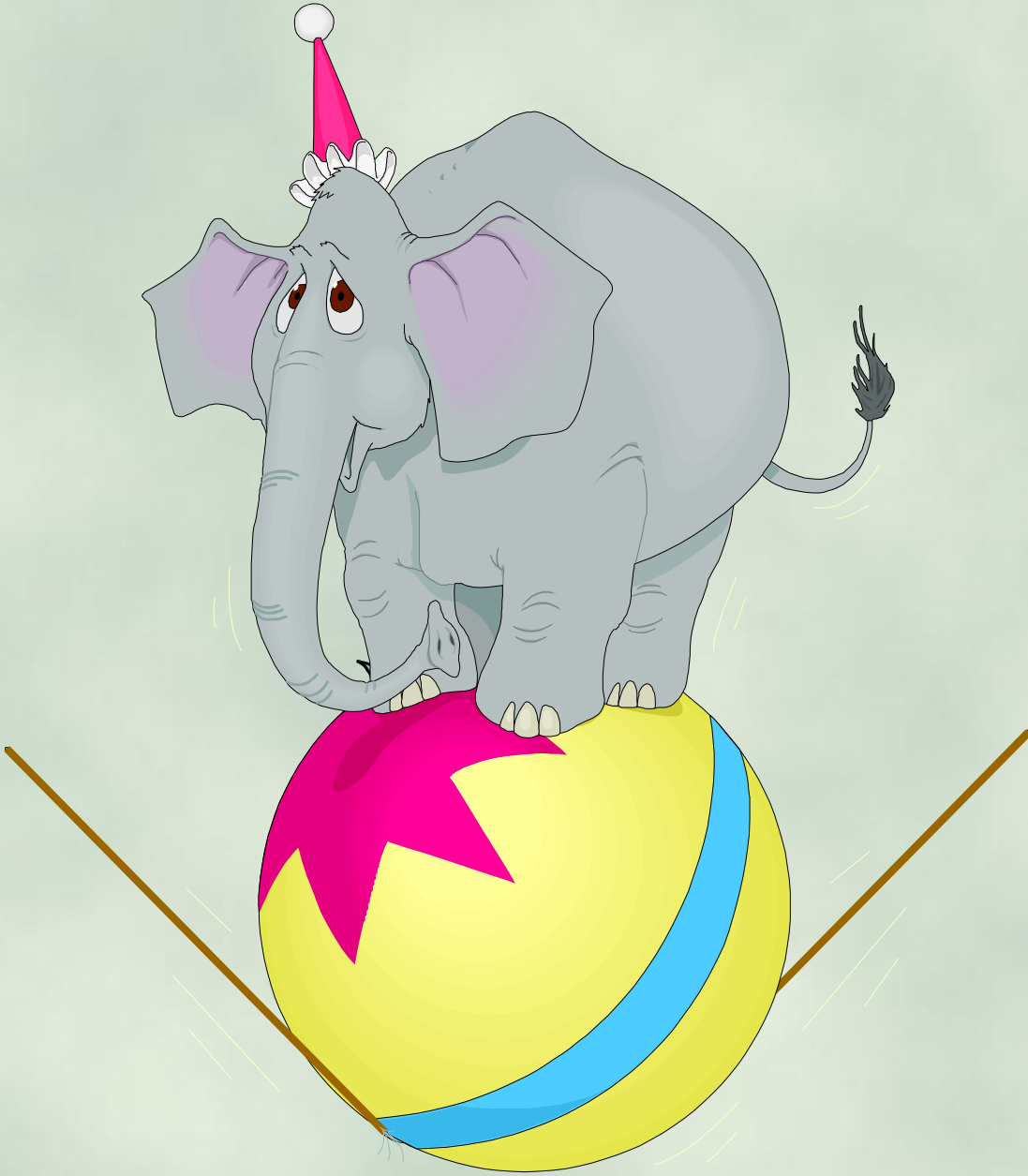
Keeping pathogens jailed!!

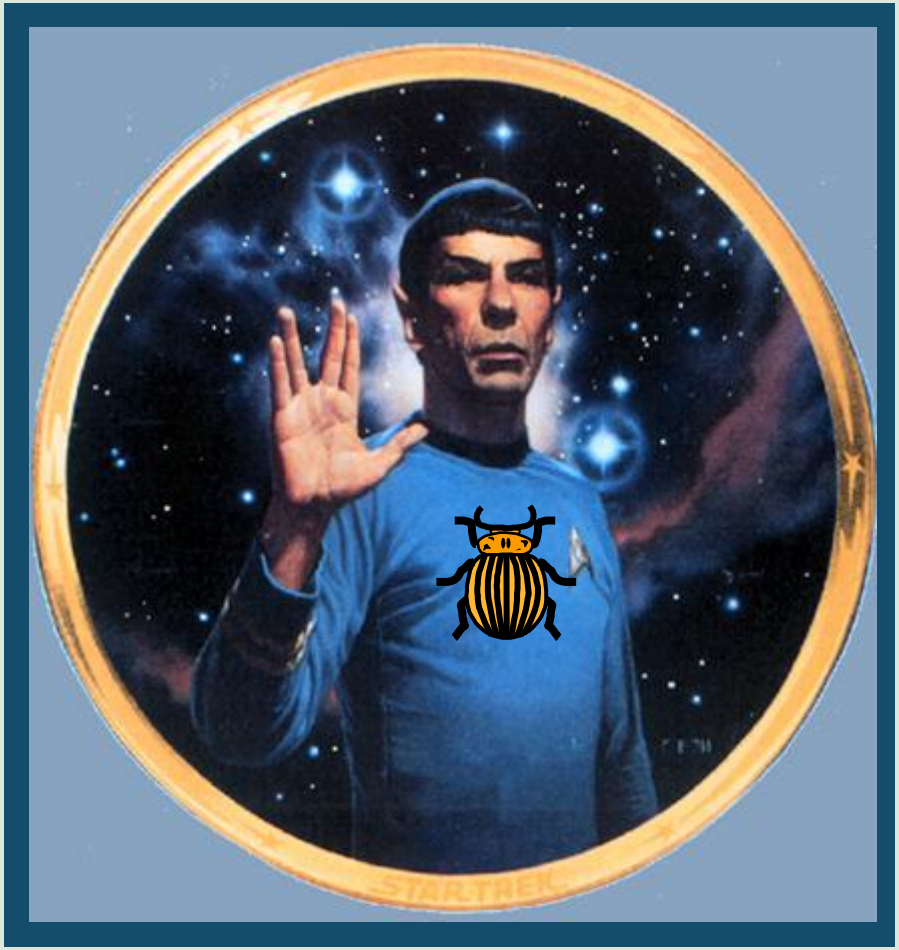
To what extent must one go to prove one's innocence?



Life is a balancing act!

Must find that balance between risk & benefit





Microbials in IPM

It is logical.